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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/828,596	04/21/2004	Ki-yeon Park	5649-1286	5520
20792 7590 09/11/2007 MYERS BIGEL SIBLEY & SAJOVEC PO BOX 37428 RALEIGH, NC 27627			EXAMINER NADAV, ORI	
			ART UNIT 2811	PAPER NUMBER
			MAIL DATE 09/11/2007	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/828,596

Applicant(s)

PARK ET AL.

Examiner

Ori Nadav

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 July 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-69 is/are pending in the application.
- 4a) Of the above claim(s) 7-10 and 16-69 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6 and 11-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-6 and 11-15 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The claimed limitation of "a metal oxide having an oxygen content that is less than a stoichiometric amount", as recited in claim 1, is unclear as to what amount is the oxygen content of the metal oxide.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-6 and 11-15, as best understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Lim et al. (2003/0040196) in view of Termath (5,506,037) and Hayashi et al. (2004/0065877).

Lim et al. teach in figure 5C and related text a method of forming a metal thin film, comprising:

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forming an oxygen-deficient metal oxide dielectric film 33 on a semiconductor substrate by atomic layer deposition (ALD, paragraph [0020]) using an organic metal compound as a first reactant (paragraph [0067]); and

forming a metal oxide dielectric film 34 on the oxygen-deficient metal oxide film by ALD using the first reactant and a second reactant, wherein the second reactant comprises an oxidizing agent.

Lim et al. do not teach forming an oxygen-deficient metal oxide film comprises a metal oxide having an oxygen content that is less than a stoichiometric amount.

Termath teach forming an oxygen-deficient metal oxide film comprises a metal oxide having an oxygen content that is less than a stoichiometric amount (column 1, lines 25-41).

Hayashi et al. teach forming an oxygen-deficient metal oxide film comprises a metal oxide having an oxygen content that is less than a stoichiometric amount (abstract).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use an oxygen-deficient metal oxide film comprises a metal oxide having an oxygen content that is less than a stoichiometric amount in Lim et al.'s device in order to improve the device characteristics. The combination is motivated by the teachings of Termath and Hayashi et al. who point out the advantages of using an oxygen-deficient metal oxide film comprises a metal oxide having an oxygen content that is less than a stoichiometric amount.

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Regarding claims 2-3, 5, 12-13 and 15, Lim et al. teach the first reactant comprises an alkoxide-based metal oxide, wherein

the first reactant comprises a lanthanum-containing compound (claim 22),
wherein

(a) feeding the first reactant onto the semiconductor substrate to form an adsorbed layer of the first reactant;

(b) removing a byproduct of (a) by means of purge; and

(c) optionally repeating (a) and (b) until the oxygen-deficient metal oxide film with a predetermined thickness is formed, and

annealing the oxygen-deficient metal oxide film, wherein the annealing is carried out after forming the oxygen-deficient metal oxide film or after forming the metal oxide film,

wherein the annealing is carried out under an atmosphere of a gas selected from the group consisting of O₂, N₂, and O₃, or combinations thereof, or under a vacuum atmosphere.

Regarding claims 4, 6, 11 and 14, Lim et al., do not explicitly state that the first reactant is selected from the group consisting of various tris or combinations thereof, the oxygen-deficient metal oxide film has a thickness in a range of about 5Å to about 30Å, wherein the method is carried out at a temperature in a range of about 200°C to about 350°C, and wherein the annealing is carried out at a temperature in a range of about 300°C to about 800°C.

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It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a first reactant selected from the group consisting of various tris or combinations thereof, the oxygen-deficient metal oxide film has a thickness in a range of about 5A to about 30A, wherein the method is carried out at a temperature in a range of about 200°C to about 350°C, and wherein the annealing is carried out at a temperature in a range of about 300°C to about 800°C in prior art's device in order to form the device, as taught by prior art, using conventional processing temperatures, thicknesses and materials.

Response to Arguments

Applicant argues that the claimed limitation of "a metal oxide having an oxygen content that is less than a stoichiometric amount", as recited in claim 1, is clear, because applicant does not have to describe the stoichiometry of every metal oxide in order to distinctly claim the subject matter of the claims:

The examiner does not suggest that applicant is required to describe the stoichiometry of every metal oxide in order to distinctly claim the subject matter of the claims. Stoichiometry is the quantitative relationship between two elements in a compound. Applicant claims "a metal oxide having an oxygen content that is less than a stoichiometric amount", without identifying the phrase "a stoichiometric amount". Therefore, it is unclear to which compound and to which element the stoichiometric amount" refers, and thus what is the amount (or the range) of the oxygen content of the metal oxide.

Note further that it may also be unclear how low the oxygen content in the metal oxide can be, since applicant only claims "a metal oxide having an oxygen content that is less than a stoichiometric amount", without providing lower limit for the oxygen content.

Applicant argues that "Lim does not teach or suggest forming an oxygen-deficient metal oxide dielectric film using an organic metal compound as a first reactant, and then forming a metal oxide dielectric film thereon using the first reactant and a second reactant", because Lim states, "FIG. 5c and FIG. 5d present a technology of alternatively stacking and oxidizing two different metal oxides to form a metal oxide film." and claim 1 recites using the same metal organic compound in forming both the oxygen-deficient metal oxide dielectric film and the metal oxide dielectric film.

Using two different metal oxides to form a metal oxide film, does not preclude an artisan from forming an oxygen-deficient metal oxide dielectric film using an organic metal compound as a first reactant, and then forming a metal oxide dielectric film thereon using the first reactant and a second reactant". Furthermore, although claim 1 recites using the same metal organic compound (the first reactant) in forming both the oxygen-deficient metal oxide dielectric film and the metal oxide dielectric film, the oxygen-deficient metal oxide dielectric film and the metal oxide dielectric film are formed by two different materials. The first material is the first reactant, and the second material is the first and second reactants.

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Applicant argues that one of ordinary skill in the art would not be motivated to combine Lim with either Termath or Hayashi, because "Termath is directed to heat-reflecting and/or electrically heatable laminated glass panes. One of ordinary skill in the art of forming semiconductor devices would not be aware of Termath because it is directed to glass panes for automobile windows or windshields".

It is unclear why the examiner was aware of Termath, and an artisan would be aware of Termath.

Applicant argues that Hayashi is directed to electroluminescent elements that include an oxygen-deficient metal oxide conductive film, and an artisan would not substitute the conductive metal oxide film of Hayashi for a dielectric metal oxide film of Lim.

The examiner does not suggest that an artisan would substitute the conductive metal oxide film of Hayashi for a dielectric metal oxide film of Lim. Hayashi is cited to teach an artisan that the dielectric metal oxide film of Lim should be made by having an oxygen content that is less than a stoichiometric amount.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ori Nadav whose telephone number is 571-272-1660. The examiner can normally be reached between the hours of 7 AM to 4 PM (Eastern Standard Time) Monday through Friday.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lynne Gurley can be reached on 571-272-4670. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



O.N.
8/31/07

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